

INDUSTRIAL REAL TIME RADIOGRAPHY

By: Paul Bestbier

1) Introduction

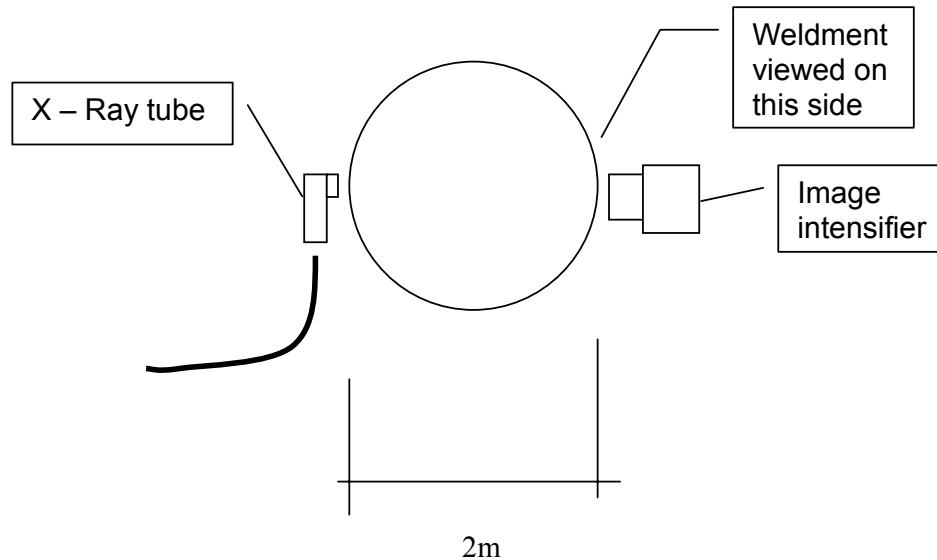
The principles and methods of real time radiography has already been discussed in a previous paper. This paper deals with the practical application of this method and until now it has been unique and not been applied elsewhere in the world.

2) Tank container industry

South Africa is the largest tank container manufacturing country in the world. We produce 40% of the world production. Intermodal containers or tank containers, are liquid carrying containers that can be shipped and transported in the same manner as so called well-known box containers.

When you are producing 20 x 26000l welded stainless steel tanks a day and having to X-Ray the weldments conventionally using film, you have a problem and a serious one at that. The tanks are made in accordance with the ASME VIII boiler and pressure vessel code and radiography is specified. This required a new approach altogether and real time radiography was the answer.

The first major obstacle was that the tank submitted for radiography was complete except for the manhole, sump and maybe 2 –3 smaller holes in the tank. The radiography had to be executed using the single image double wall technique as demonstrated in the drawing below.



This has never been done before and the suppliers of the X-Ray equipment indicated it was impossible due to the long distance (2 –2,5m) from the X-Ray tube to the image intensifier. Physics just did not allow this. We here in Cape Town, unaware of these physical constraints, went ahead and designed a system for this purpose.

This called for special planning and considerable development had to go into this without any previous model to try and emulate. The factory layout was carefully planned around the handling of the tanks because this system requires the “patient” in this case a 316 L stainless steel tank with a mass of +- 4 metric tons to be brought to the container manipulating carriage with the least possible crange and effort. The area had to be close to the production line activities before and after radiography.

The building had to be safe and not hazardous to personnel working in close proximity. This was achieved and no radiation is detected right next to the building and within 2 meters of the openings. No person can approach the radiation area without the infrared movement sensors switching the machine off.

The X – Ray tube had to be carefully selected to achieve the required sensitivity and quality. The tube has two focal spots, one of 3mm and the other 0,4mm. The smaller focal spot is for the inspection of the dished end weldments before forming and welding to the tank. The material thickness varies between 4,6mm and 9mm for the dished end. The weld process is automatic, Plasma Tig.

The image obtained as is, does not comply with the specification requirements and to overcome this image enhancement have to used to produce the required quality to the satisfaction of all clients and inspection authorities. The image enhancement by means of integration and contrast adjustment improves the image without changing the results obtained. It just improves the image.

Image enhancement can only take place when the object, on this case the tank is stationary. It also takes some 20 milliseconds to achieve. This required special programming of the movement of the manipulating carriage and the image-processing computer to perform these operations automatically. This enabled us to inspect welds at 1m/min

The image is automatically stored together with all relevant information e.g. Identification, position, date, time and any other information that may be required. The image cannot be changed after it has been stored on CD . The images are in the Bitmap format making it easy to view with all present day PC's it can be altered but the CD image cannot be altered.

4) Cost factor

Conventional radiography required three full time radiographers, one full time processor and one film interpreter. This was reduced to 2 operators for the real time system. The film costs, which came to R70 000 (\$6600), a month has been cut to 0. The greatest saving of course was the work in progress was reduced dramatically. Conventional radiography had to provide 3 weeks stock ahead to maintain normal production. This was one of the contributing factors to enable us to be the top container manufacturer in the world. In Cape Town there at present two manufacturers using these systems and the records of the images on CD

5) Future developments

At present the images can only be processed whilst the object is stationary. Present computer speed cannot process fast enough. This, as we all know may change to make this possible.

6) Conclusion

The implementation of real time radiography in South Africa in the tank container industry has helped us to be very competitive hence our standing as a world-class producer.

7) Images



Dish end disc radioscapy



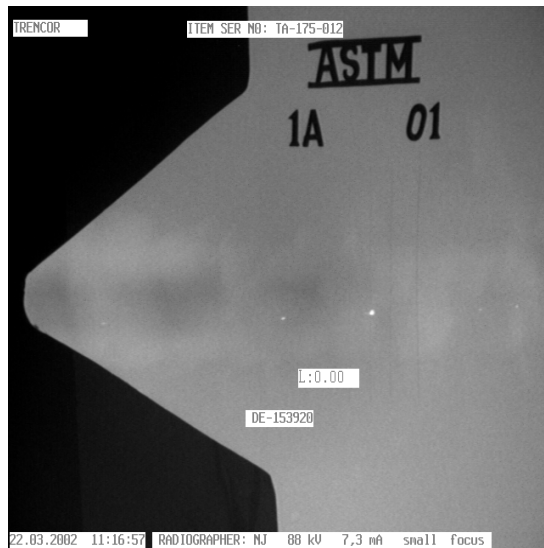
Formed dish end ready for assembly



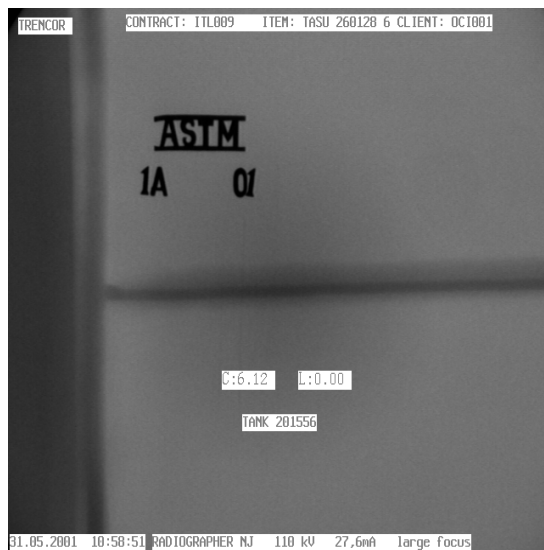
Dish end assembled to barrel



Tank in exposure room



Dish end disc image. Weld ground flush. Porosity



Double wall single image



Completed container tank ready for delivery

Acknowledgement and thanks to:- **Trencor Tank Containers**